Section 10 - Hydraulic / Pneumatic Actuators

Introduction

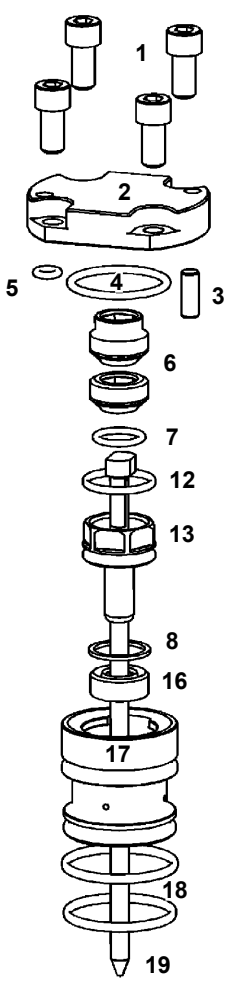
This section explains how to assemble and install the valve actuator for:

- 5500 Series
- 6500, 6600, and 6700 Series
- 7100 Series

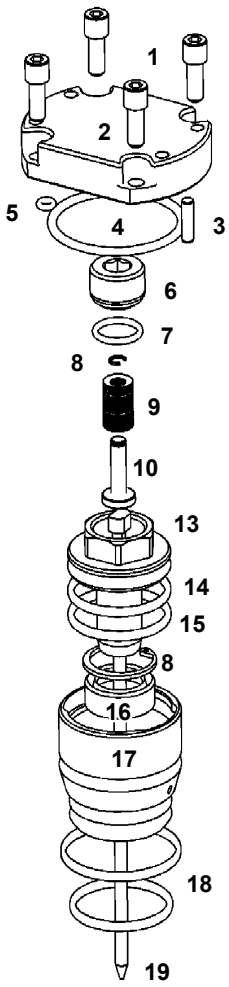
Installation and Assembly of the Valve Actuator

The following procedure explains how to assemble and install the valve actuator on a bench.

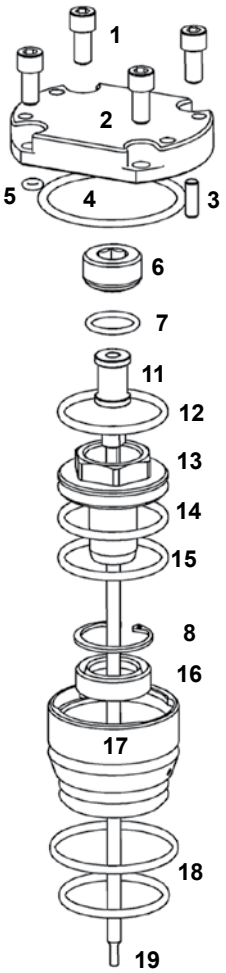
NOTE
These procedures require certain parts to be lubricated or greased.



5500 Series



6X00 Series



7100 Series

Valve Actuator Components

1. Screw
2. Cylinder Top
3. Locating Dowel
4. Cylinder Top O-Rings
5. Small O-Ring
6. Piston Top
7. O-Ring
8. Circlip
9. HY6X00 Spring Assembly
10. HY6X00 Stud
11. HY7100 Spacer
12. Outer Seal
13. Piston
14. Inner Viton O-Ring
15. Outer Viton O-Ring
16. Rod Seal
17. Cylinder
18. Cylinder Bottom O-Rings
19. Valve Pin

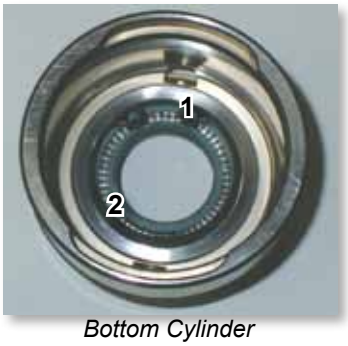
Figure 10-1

Pre-Installation

1. Prior to installing the actuator unit, check that all fluid lines in the mold plate are de-burred and do not have any metal chips.
2. Remove all rust inhibitor from the exterior of each part, prior to installation.
3. Use denatured alcohol to remove the rust inhibitor compound from each part. Do not clean the interior of the cylinder.

Cylinder Bottom Assembly

1. Insert the rod seal support disk into the cylinder (6X00 and 7100 only).
2. Press the rod seal into position.
3. Install the circlip with sharp edges facing up.
4. Lubricate the bottom cylinder external O-rings and install.



Bottom Cylinder
1. Circlip 2. Rod Seal

Figure 10-3 6X00 and 7100 Bottom Cylinder O-Rings

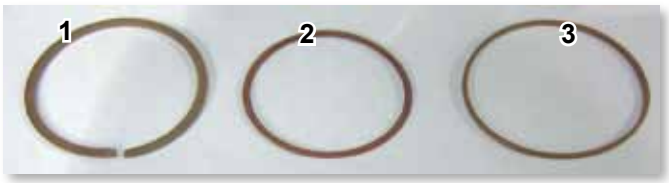


Figure 10-4 Seal Kit PS0003
1. Back Up Ring 2. Inner Viton O-Ring 3. Outer Seal

Piston Assembly

5500 Only

1. Lightly use silicone grease and install the O-ring on the piston.

6X00 and 7100 Series

1. Using silicone grease, lightly grease and install the inner Viton O-ring on the piston.
2. Install the back-up ring.
3. Install the outer seal. The seal should sit on top of the inner Viton O-ring. An installation tool is available (PS0003TOOL02) for installing the seal.
4. Once all 3 rings have been assembled, place installation tool PS0003TOOL01 over assembly as shown and allow rings to settle.

Figure 10-5 Piston Assembly
1. Back Up Ring 2. Inner Viton O-Ring 3. Stud

Figure 10-6 Piston Assembly
1. Outer Seal 2. Installation Tool 3. Stud

Figure 10-7 Piston Assembly
1. Stud 2. Installation Tool PS0003TOOL02

Cylinder Top Assembly

On the inside face of the cylinder top:

1. Insert the locating dowel.
2. Using silicone grease, lightly grease and insert the small O-ring.
3. Using silicone grease, lightly grease and insert the large O-ring.

Figure 10-8 Typical Cylinder Top
1. Large O-Ring 2. Small O-Ring
3. Cylinder Top 4. Locating Dowel

Valve Pin Finishing of Tip

5500 Series

1. Install the cylinder (where applicable) and piston bottom, (without the pin and piston top) into the hydraulic plate.
2. Measure the distance AD and AC.

NOTE
Heat expansion difference to be removed from pin head.

3. Cut pin to calculated length "L". (L = AD - AC + DE + 3.05*+0.02**)
   L = overall length from tip to top of pin head
   * 3.05 = head of pin
   ** 0.02 = pressure preload

4. Grind the valve pin tip an angle of 20° per side (40° inclusive).

5. Lap the tip of the pin into the land area (steel section in the gate area). Refer to Figure 10-10 using a lapping guide bushing or valve bushing as a lapping guide. Recommended lapping paste 400 - 600 grit.

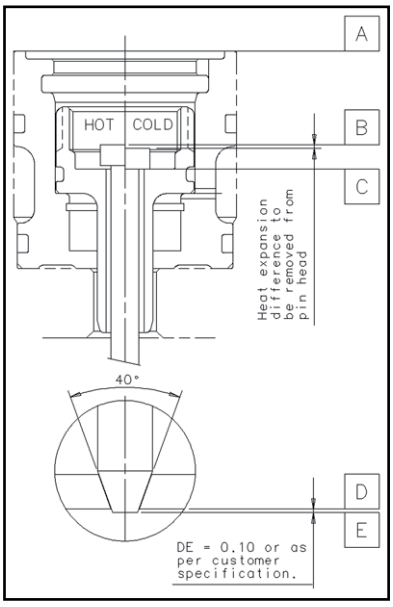


Figure 10-9 Measure Distance

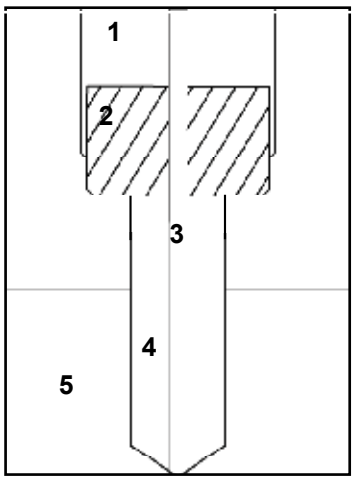


Figure 10-10a 1. Nozzle Flange Bore 2. Machined Bushing for Center Alignment 3. Tapered/Angled Valve Pin 4. Nozzle Well Bore 5. Cavity

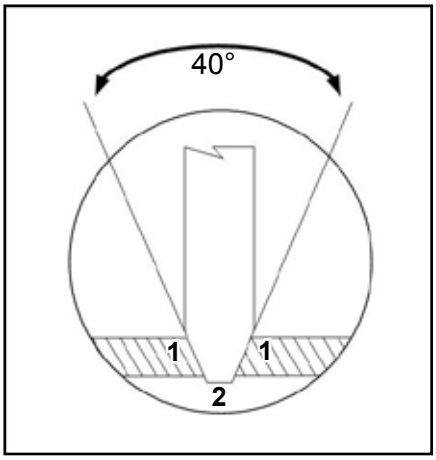


Figure 10-10b Land Location
1. Land Area 2. Cavity Face

6X00 Series

1. Calculate the heat expansion factor.
   Fh = (Processing temperature - Mold temperature) °C x 0.000012.
2. Calculate the heat expansion of the valve pin.
   HE = distance BC x heat expansion factor = BC x Fh
3. Cut pin to calculated length “L”. (L = AC - 36.35 - HE + 0.3 + CD).
4. Grind the valve pin tip to an angle of 20° per side (40° inclusive). Refer to Figure 10-7.
5. Lap the tip of the pin into the land area (steel section in the gate area) using a lapping guide bushing or valve-bushing as a lapping guide. Recommended lapping paste 400 - 600 grit.

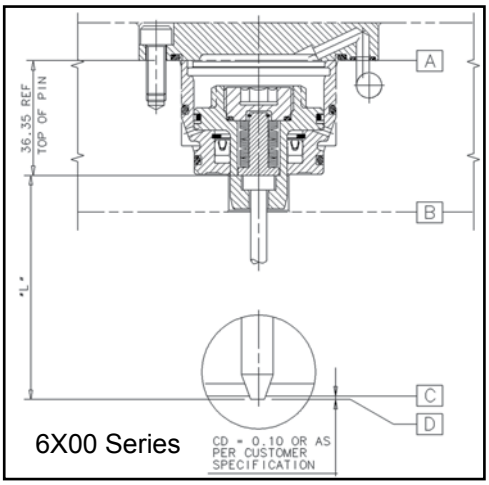


Figure 10-11 Measure Distance

7100 Series

1. Install the cylinder (where applicable) and piston bottom, (without the pin and piston top) into the hydraulic plate.
2. Measure the distance AC and BC.
3. Calculate the heat expansion factor.
   Fh = (Processing temperature - Mold temperature) °C x 0.000012.
4. Calculate the heat expansion of the valve pin.
   HE = distance BC x heat expansion factor = BC x Fh
5. Cut pin to calculated length “L”. (L = AC - 36.35 - HE + CD)
6. Grind the valve pin tip to fit the cylindrical gate. (Refer to the system gate detail.)
7. Assemble the hydraulic unit.
8. Heat the hot runner system to processing temperature.
9. Soak the pin in the hot runner system for 10 minutes to achieve the maximum heat expansion of the pin at the processing temperature. (Mold cooling should be running).
10. Measure the distance CD in the heated condition. Check that the head of the pin is seated.
11. Calculate the dimension to be ground (L2). L2 = CD (measurement) - CD (specified).
12. Grind the pin end to remove L2 (finish cut).

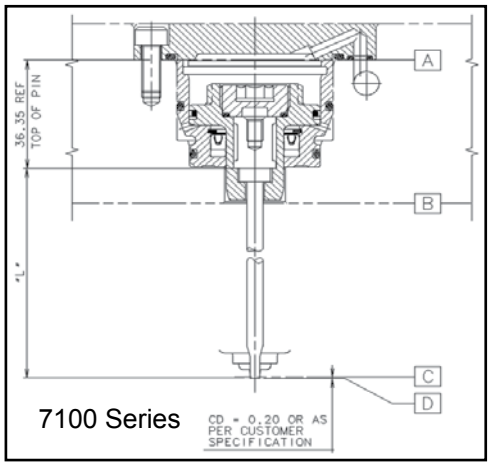


Figure 10-12 Measure Distance

NOTE
When the gate vestige is critical, it is recommended to mold sample parts and measure samples to adjust the final pin length.

Steel quality in the gating area must have:

- High grade of toughness (H13, 1.2344)
- Hardness of HRc, 46-48
- No nitration
- No chrome plating

The bottom of the nozzle well in the gate area must be free of stress caused by:

- Rough EDM
- Rough machining
- Sharp corners (JIG grinding is recommended)

Valve Pin Lapping Procedure for Tapered Valve Pins

5500 and 6X00 Series

If the shut off between the valve pin and gate area is not satisfactory, lapping of the valve pin into the gate will be required. A support bushing that fits into the nozzle flange area should be manufactured with the pin diameter in the center of the support bushing to properly align the pin with the gate area (see below). Or use the nozzle well diameter of the cavity for the support bushing as a lapping guide.

1. Install the machined bushing with the center hole matching the pin diameter.
2. Insert the valve pin through the bushing.
3. Add 400 grit lapping paste to the tapered area of the pin and lapp into the gate. Verify the shut-off with bluing compound.
4. Be sure to remove all lapping paste from the valve pin and cavity, before continuing with actuator assembly.

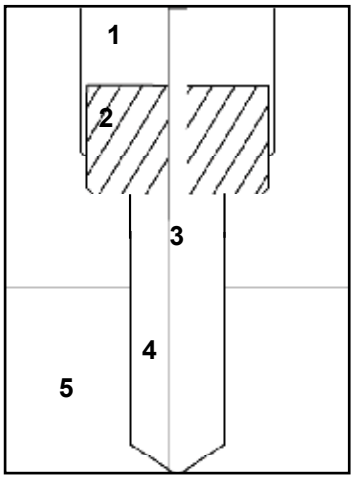


Figure 10-13 Bushing for Pin Lapping
1. Nozzle Flange Bore 2. Machined Bushing for Center Alignment
3. Tapered/Angled Valve Pin 4. Nozzle Well Bore 5. Cavity

NOTE
Do not permit the lapping paste to enter the valve bushing bore.

WARNING
Avoid skin contact with decomposing O-rings. Use appropriate protective clothing. Failure to do so can cause serious injury.

NOTE
The Viton O-rings used for the valve actuators are rated for operation below 200°C (400°F). Always turn ON the plate cooling prior to heating the hot runner system. Refer to the warning if O-rings have been subjected to higher than rated temperatures.

Valve Pin Finishing of Head

5500 Series

1. Heat the hot runner system to the processing temperature.
2. Allow the pin to soak in the hot runner system for 10 minutes to achieve the maximum heat expansion of the pin at processing temperature. (Mold cooling must be running).

WARNING
Extreme heat. Avoid contact with heated surfaces.
Use appropriate protective clothing. Failure to do so can cause serious injury.

3. Measure the distance AB in heated condition.

NOTE
Heat expansion difference to be removed from pin head.

4. Check that the tip of the pin is fitted correctly into the land.
5. The heat expansion difference between the mold and hot runner is removed by grinding the back of the pinhead.
6. HED = AC - (AB + 3.05 + 0.02 preload)
   HED = heat expansion difference
   * 3.05 = head of pin
   ** 0.02 = pressure preload

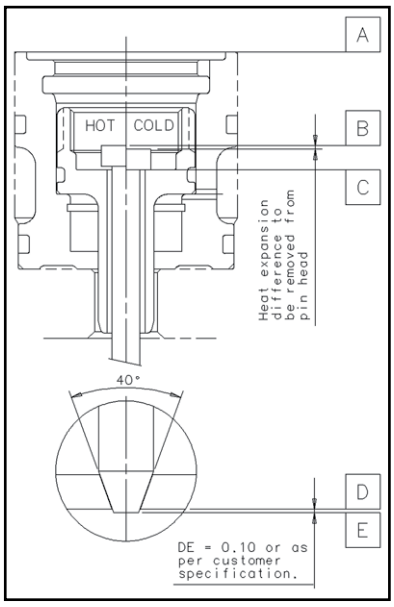


Figure 10-14 Measure Distance

7. Continue to re-assemble the actuator assembly. The maximum pin preload in the land under full heat expansion must not exceed 0.02mm.

NOTE
The standard stroke of the HY550* A/E is 4.0mm. This can be increased to maximum of 8.0mm by removing material from the piston top.
The stroke of the HY550* C/F is 8.0mm and cannot be altered.

Valve Pin Assembly

5500 Series

1. Check the valve pin length. Refer to:
   "*Valve Pin Finishing of Tip*",
   "*Valve Pin Finishing of Head*".
2. Slide the valve pin into the piston.
3. Grease and install the O-ring.
4. Install the piston top and tighten, torque setting 15-20 ft -lbs (20-27 Nm).

6X00 Series

1. Check the valve pin length. Refer to Valve Pin Finishing of Tip.
2. Slide the valve pin into position.

CAUTION
Failure to install the disk springs in the correct order will cause damage to the gate.

3. Assemble the disk springs to the spring retainer stud.
    a. Check for the correct orientation of the disk springs when installing.
    b. HY6500 series: Align the springs in 5 alternating groups of 5, convex and concave.
    c. HY6600 and 6700 series: Align the springs in 8 alternating groups of 6, convex and concave.
4. Install the disk spring assembly on top of the valve pin.
5. Grease and install the O-ring.
6. Install piston top and tighten, recommended torque setting 15-20 ft-lbs (20-27 Nm).

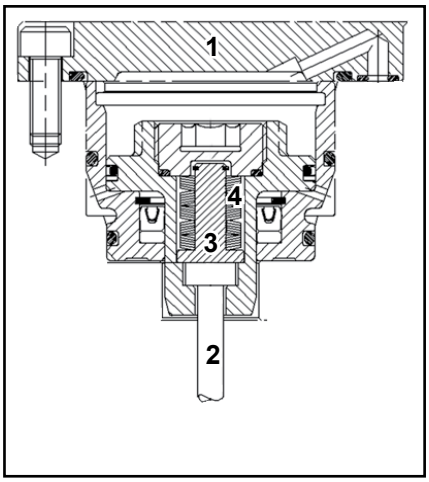


Figure 10-15 8 X 5 Disk Spring Assembly
1. Cylinder Top 2. Valve Pin 3. Spring Retainer Stud 4. Disk Springs

7100 Series

1. Check the valve pin length.
2. Slide the valve pin into the piston.
3. Install the actuator spacer with the threaded side facing towards the piston top.

NOTE
The threaded side is used for removal or installation use. By installing a screw into the spacer's threaded end it allows for simple extraction of the spacer.

4. Grease and install the O-ring.
5. Install piston top and tighten, recommended torque setting 15-20 ft-lbs. (20-27 Nm).

Figure 10-16 Piston Spacer Installation
1. Threaded Side 2. O-Ring 3. Spacer Installed (Threads Up) 4. Piston 5. Piston Top

Installing the Valve Actuator to the Hydraulic Plate

The following procedure is for new systems.

1. Lubricate the sides of the actuator cylinder, before installing into the hydraulic plate.

CAUTION
Check for sharp edges before installing the cylinder. Failure to do so could damage O-rings.

Figure 10-17 Cylinder Installation

2. Tap the cylinder into the bore of the actuator plate with a nylon mallet.
3. Position the piston installation tool (PS0003TOOL01) on top of the cylinder.
4. Install the valve pin and piston into the cylinder bottom.
5. Press the valve pin into position, using a nylon mallet to finish seating the valve pin into the assembly.

CAUTION
Heat sensitive materials should be purged with a compatible less sensitive material.
If the system is not purged material in the manifold could degrade resulting in poor quality of product.

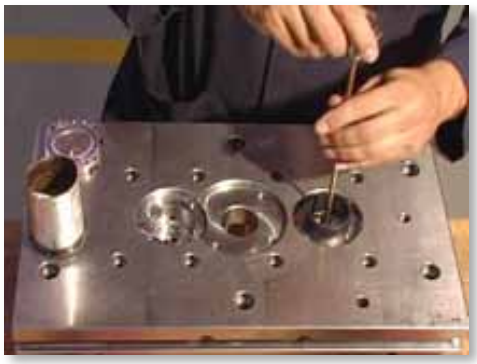


Figure 10-18 Valve Pin and Piston Installation
1. Valve Pin and Piston 2. Installation Tool

6. Remove the installation tool.
7. Check that the cylinder top dowel and O-rings are installed.
8. Install the cylinder top.

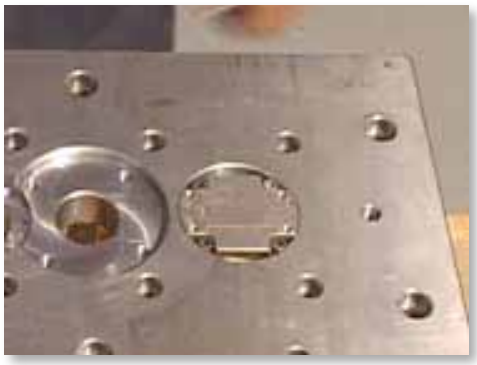


Figure 10-19 Cylinder Top
1. Cylinder Top 2. Mounting Screws 3. Hydraulic Plate

Maintenance Procedure

HY5500, HY6X00 and HY7100 Series

Actuator units should be inspected every 12 months or per pre-determined maintenance schedule. The following procedure is performed on a bench.

For Oil Systems:

1. Remove oil from system.
2. Remove the cylinder top with tool in upright position to prevent oil from entering the system.
3. Heat up the system (required to remove the valve pin).

Figure 10-20 HY5500 Series Cylinder Extraction Tool Kit

For Pneumatic Systems:

1. Remove the cylinder top for every zone.
2. Heat up the system (required to remove the valve pin).

WARNING
Extreme Heat. Avoid contact with heated surfaces. Use appropriate protective clothing. Failure to do so can cause serious injury. If possible keep cooling on within hot half.

Do not assemble new O-rings if the plates are still hot. Drain the oil before removing the pin from the hydraulics.

*Figure 10-21 HY6/7*00 Series Cylinder Extraction Tool Kit*

3. Install the cylinder extraction tool to assist with the removal of the cylinder.
4. Disassemble the system.
5. Inspect components.
6. Replace O-rings.
7. O-ring replacement kit is OR550P1 for 5500 series and OR650P2 for 6X00 and 7100 series.
8. When installing the rod seal, check that the rod seal is seated to the base of the cylinder and is secured in place with the circlip.
9. To complete the assembly, refer to:
    a. Cylinder Bottom Assembly
    b. Piston Assembly
    c. Cylinder Top Assembly
    d. Figure Valve Pin Assembly
    e. Installing the Valve Actuator to the Hydraulic Plate.

Figure 10-22 Valve Disk Extraction Tool

Extraction Tool Assembly